DIFFERENTIAL CLEARING OF *ACACIA COLLINSII* BY *PSEUDOMYRMEX SPINICOLA* AND *P. FLAVICORNIS*

CARTER D. WRAY, VANESSA R. LEVESQUE, WENDY L. OSTERLING, NICOLE D. POULIOT AND IAN J. STEWART

Abstract. In a previous study, Bizzarro et al. (1992) suggested that *Pseudomyrmex spinicola* (common red acacia ants) clear vegetation around their host trees, *Acacia collinsii*, more effectively than do *P. flavicornis* (common black acacia ants). We tested this hypothesis, but controlled for size and habitat variations between trees. We found that *P. spinicola*-occupied trees had significantly less cover <1m tall near their bases than did *P. flavicornis*-occupied trees. This suggests that *P. spinicola*-occupied trees may be at a competitive advantage over *P. flavicornis*-occupied trees.

INTRODUCTION

Acacia collinsii (acacias) benefit from inhabitation by ants because the ants deter herbivores and remove vegetation within a radius of 1 to 4m around the tree, reducing competition from other plants that could hinder acacia growth (Janzen 1983). Many different species of ants are found on acacia plants. *Pseudomyrmex flavicornis* (common black acacia ants) and *P. spinicola* (common red acacia ants) have obligate associations with acacia trees.

P. spinicola attack foreign vegetation more aggressively than *P. flavicornis* (Janzen 1983). In Palo Verde National Wildlife Refuge, Costa Rica, trees inhabited by *P. spinicola* had a larger cleared area and a significantly lower percent cover around their bases (Bizzarro et al. 1992). However, that study did not control for size of trees and habitat variations between trees inhabited by the two ant species. Therefore, we re-examined clearing under acacias, controlling for these factors, by pairing each *P. flavicornis* inhabited tree surveyed with the nearest *P. spinicola* tree in the same size class. We hypothesized that *P. spinicola* ants clear away more vegetation than *P. flavicornis* under their host trees.

METHODS

To examine both *P. flavicornis*- and *P. spinicola*-occupied acacia trees, we chose an area that appeared to be typical of those containing ant-acacias at Palo Verde National Wildlife Refuge, Costa Rica. We sampled a 20 m wide transect along the Sendero Natural La Venada Trail beginning 20m from the junction with the main road to Bagaces. Because *P. flavicornis*-occupied trees were relatively scarce, we located and tagged all such trees and paired them with the nearest tree of the same size class containing *P. spinicola*. Proceeding this way, we sampled a transect length of 194 m.

Trees were placed in three height classes: I (0-1 m), II (1-3 m) and III (>3 m). Trees were surrounded by a square plot that was determined by tree size class. A 0.6 m^2 plot was centered around each tree of size class I, a 1.3 m^2 plot was centered around each tree of size class II, and a 1.6 m^2 plot was centered around each tree of size class III. Within each square plot, the percentage of green ground cover <1 m tall was recorded in one of four cover classes: <1%, 1-5%, 5-25%, or 25-50%. Cover was never >50%.

We found 34 *P. flavicornis*-occupied trees. However, all but six trees were found in clumps, creating the potential for non-independent results, because of the possibility that all trees in a clump were inhabited by the same colony of ants. To eliminate non-independence, we randomly selected one *P. flavicornis*-occupied tree from each clump and compared it to the nearest *P. spinicola*-occupied tree. We then compared the numbers of *P. flavicornis*- and *P. spinicola*-occupied trees in each cover class.

RESULTS

P. spinicola cleared significantly more vegetation from around their host trees than did *P. flavicornis* (G=5.422, df=14, P<0.025; Fig 1). For this test, the size classes were condensed from four classes to two classes (<5% and 5-50% cover) to eliminate zero values.

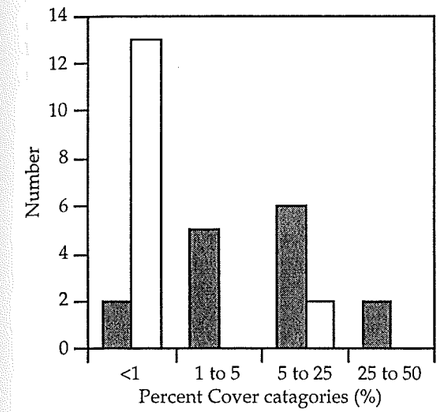

FIG. 1. Percent cover of vegetation <1 m tall under trees inhabited by *P. spinicola* (grey bars, n=15) and *P. flavicornis* (white bars, n=15)

DISCUSSION

Acacia trees with more clearing around them should experience reduced competition for light and nutrients. Because *P. spinicola* clears significantly more extensively than does *P. flavicornis*, acacias harboring colonies of *P. spinicola* should be at a competitive advantage over trees with *P. flavicornis* colonies. Natural selection may therefore act on acacias to promote colonization by *P. spinicola* rather than colonization by P. *flavicornis*. However, it is unclear what, if any, traits could be selected to differentially attract *P. spinicola*.

P. flavicornis devotes less energy to clearing of vegetation, yet persists in a mutualistic relationship with acacia trees despite this potential fitness cost to their host. *P. flavicornis* may be able to maintain its proportion of occupied acacias through re-allocation of energy from clearing to reproduction or by faster colonization of young trees than *P. spinicola*.

Although it appears that *P. spinicola* clears more than *P. flavicornis*, we do not know the extent to which *P. flavicornis* aids its host. We do not know if the vegetation around *P. flavicornis*-occupied trees is more sparse than vegetation around non-acacia trees in the same area. The degree of aid the ants contribute to the host tree could be established by quantifying the percent cover around acacias hosting colonies of *P. flavicornis* relative to random samples of ground vegetation around other trees in the area.

Our observations suggest that while *P. spinicola* does clear more vegetation around its host tree, *P. flavicornis* also shows some clearing ability. Both species should thus be aiding their hosts by reducing competition from neighboring vegetation, but *P. spinicola*-occupied trees appear to benefit the most.

LITERATURE CITED

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